COST AND PERFORMANCE REPORT

EXECUTIVE SUMMARY

This report presents cost and performance data for an in situ vitrification (ISV) treatment application at the Parsons Chemical/ETM Enterprises Superfund Site (Parsons) in Grand Ledge, Michigan. The Parsons site is a former agricultural chemicals mixing, manufacturing, and packaging facility. Soils and sediments at the Parsons site were contaminated with pesticides, heavy metals, and dioxins.

ISV treatment of approximately 3,000 yds^3 of contaminated soils and sediments at the Parsons site, consisting of eight melts, was completed from May 1993 to May 1994; this was notable for being the first full-scale application of ISV treatment at a Superfund site.

The melts are expected to cool by May 1995, at which time additional samples of vitrified soils are planned to be collected. Preliminary results for surface soil samples and stack gas emissions measured during the SITE Demonstration, and results for typical stack gas emissions provided by the vendor, met the soil cleanup standards and off-gas State ARARs for this application. The stack gas emissions for chlordane and 4,4'-DDT were several orders of magnitude lower than the ARARs. A volume reduction of approximately 30% for the test soil was achieved in this application, based on the results from analyses of soil dry density.

The cleanup contractor's cost ceiling for the ISV treatment application at Parson's was $1,763,000, including $800,000 for vitrification, which corresponds to $270 in costs for vitrification per cubic yard of soil treated. The estimated before-treatment costs for this application of $800,000 were high because of the need to excavate and stage the wastes prior to treatment.

SITE IDENTIFYING INFORMATION

Identifying Information:

Parsons Chemical/ETM Enterprises
Grand Ledge, Michigan
CERCLIS # MID980476907
Action Memorandum Date: 21 September 1990

Treatment Application:

Type of Action: Removal
Treatability Study associated with application? Information not available at this time
EPA SITE Demonstration Program test associated with application? Yes (see Reference 41)
Period of operation: 5/93 - 5/94
Quantity of material treated during application: 3,000 cubic yards of contaminated soils and sediments (5,400 tons) [41]

Background

Historical Activity that Generated Contamination at the Site: Mixing, manufacturing, and packaging of agricultural chemicals

Corresponding SIC Code: 2879 (Agricultural Chemicals - not elsewhere classified)

Waste Management Practice that Contributed to Contamination: Manufacturing process

Site History: The Parsons site, located near Grand Ledge, Michigan, as shown in Figure 1, is a former agricultural chemicals mixing, manufacturing, and packaging facility. Materials handled during Parsons' operation included pesticides, herbicides, solvents, and mercury-based compounds. Parsons occupied the property from April 1945 until 1979. The site is presently owned by ETM Enterprises, a manufacturer of fiberglass. [2]

SITE IDENTIFYING INFORMATION (CONT.)

Background (cont.)

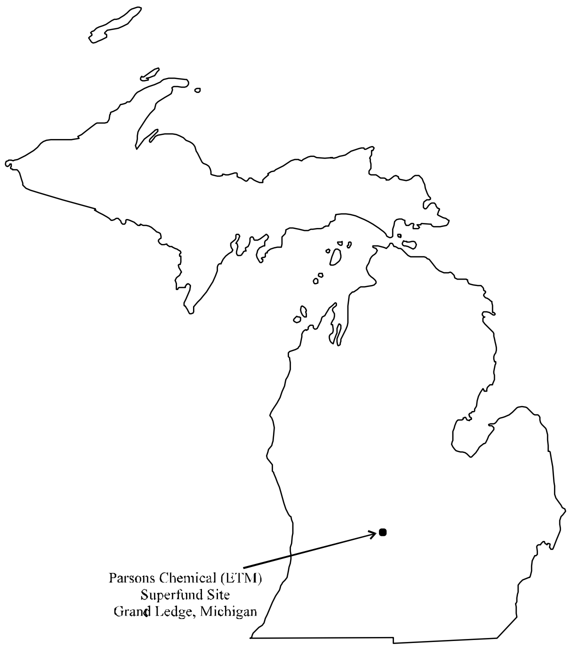

Figure 1. Site Location

Wash water from Parsons' operations was discharged through floor drains to a catch basin leading to the county drain system. The county drain system flows to an unnamed creek which ultimately empties into the Grand River. In 1979 and 1980 the Michigan Department of Natural Resources (MDNR) collected sediment samples from the unnamed creek and a ditch located on the north boundary of the site. Elevated levels of lead, mercury, arsenic, and pesticides, including dichloro-diphenyl-trichloroethane (DDT) and chlordane were detected in the samples. A hydrogeological investigation, performed during 1980, identified a septic tank and leach field system as the source of contamination. The septic tank and leach field were subsequently excavated in 1983.

Parsons was included in the Tier 3 dioxin screening under the National Dioxin Study conducted in 1984. 2,3,7,8-Tetrachlorodibenzo-p-dioxins (TCDD) was detected in the ditch sediments at the site at a concentration of 1.13 ppb at the surface and 0.56 ppb 18 inches below the surface. [2, 27]

Regulatory Context: An action memorandum, dated September 21, 1990, was approved by EPA to conduct a removal action at the Parsons site. The removal actions proposed for the site included [2]:

- Developing and implementing a site safety plan and security measures;
- Implementing a site air monitoring program;
- Characterizing, excavating, and staging all contaminated soils to facilitate the ISV process;
- Conducting a study to confirm that contaminated soils have been removed to acceptable levels;
- Treating on-site waste in a staging area utilizing ISV; and
- Completing site restoration in excavation and treatment areas.

Cleanup requirements for the site were established for near-surface vitrified materials and air emissions, as discussed below under cleanup goals and standards. [25]

Remedy Selection: Several options were considered for cleanup of the Parsons site, including ISV, incineration, and stabilization. ISV was selected as the remedy because this technology was determined to reduce volume by 20 to 30%, decrease the toxicity to near zero, and permanently immobilize the hazardous substances on the site. ISV was also identified as less expensive than on-site incineration. [2]

SITE IDENTIFYING INFORMATION (CONT.)

Site Logistics/Contacts

Site Management: Fund Lead
Oversight: EPA
On-Scene Coordinator:
Len Zintak
U.S. EPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3507
(312) 886-4246

Treatment System Vendor:
James E. Hansen
Geosafe Corporation
2950 George Washington Way
Richland, WA 99352
(509) 375-0710

MATRIX DESCRIPTION

Matrix Identification

Type of Matrix processed through the treatment system: Soil (in situ)

Contaminant Characterization

Primary contaminant groups: Pesticides, heavy metals; and dioxin

The maximum concentrations measured in the soil at Parsons for specific contaminants are shown in Table 1. [27]

Table 1. Maximum Contaminant Concentrations in Soil [27]

Contaminant	Maximum Concentrations in Soil (µg/kg)
g-BHC (Lindane)	78000
Bis(2-ethylhexyl) phthalate	28000
Butyl benzyl phthalate	6400
Chlordane	89000
4,4'-DDD	48000
4,4'-DDE	37000
4,4'-DDT	340000
Dieldrin	87000
Endosulfan sulfate	1300
Fluoranthene	1200
Hexachlorobenzene	2600
Mercury	34000
Methoxychlor	850
2-Methylnaphthalene	1100
Phenanthrene	990
Pyrene	1400
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	1.13
Zinc	150000

MATRIX DESCRIPTION (CONT.)

Matrix Characteristics Affecting Treatment Cost or Performance

The major matrix characteristics affecting cost or performance for this technology and their measured values are presented in Table 2.

Table 2. Matrix Characteristics [4, 11]

Parameter	Value	Measurement Procedure
Soil Classification	Silty Clay	Not Available
Clay Content and/or Particle Size Distribution	Not Available	-
Moisture Content	Not Available	-
Soil Dry Density	1.48 tons/yd³	Not Available

The soil at Parsons was reported to be difficult to work with under very wet and very dry conditions. Wet conditions caused the soil to become highly fluid and exhibit a noticeable sulfurous odor. Under dry conditions, the soil became concrete-like. The soil also had a very high moisture content, and the soil moisture contained a high level of dissolved solids. [25]

TREATMENT SYSTEM DESCRIPTION

Primary Treatment Technology

In Situ Vitrification

Supplemental Treatment Technology:

Post-treatment (air) using quench, scrubber, and thermal oxidizer

In Situ Vitrification System Description and Operation

In situ vitrification (ISV) is an immobilization technology designed to treat media contaminated with organic, inorganic, and radioactive contaminants. The primary residual generated by ISV is the vitrified soil product. Secondary residuals generated by ISV include air emissions, scrubber liquor, carbon filters, and used hood panels. [41]

System Description

The ISV system used at Parsons consisted of 9 melt cells, as shown in Figure 2, an air emissions control system, and associated equipment. The melt cells were installed in a 16-foot deep treatment trench; each cell was 26 feet by 26 feet square. The trench was designed with a cobble wall and drain system to direct perched water that flowed into the site around the melt cells. [25]

The air emissions control system used at Parsons consisted of an off-gas collection hood, a quencher, a water scrubber, and a thermal oxidizer. The thermal oxidizer was added midway through the project to help control stack gas odors. [25]

Associated equipment used at the Parsons site included electrical transformers, capacitor tanks, natural gas metering equipment, and thermocouples and other monitoring equipment. [13]

The following technology description is an excerpt from the SITE Technology Capsule [41]:

"The ISV Technology [used at Parsons] operates by means of four graphite electrodes, arranged in a square and inserted a short distance into the soil to be treated. A schematic of the Geosafe process is presented in Figure 3.

TREATMENT SYSTEM DESCRIPTION (CONT.)

In Situ Vitrification System Description and Operation (cont.)

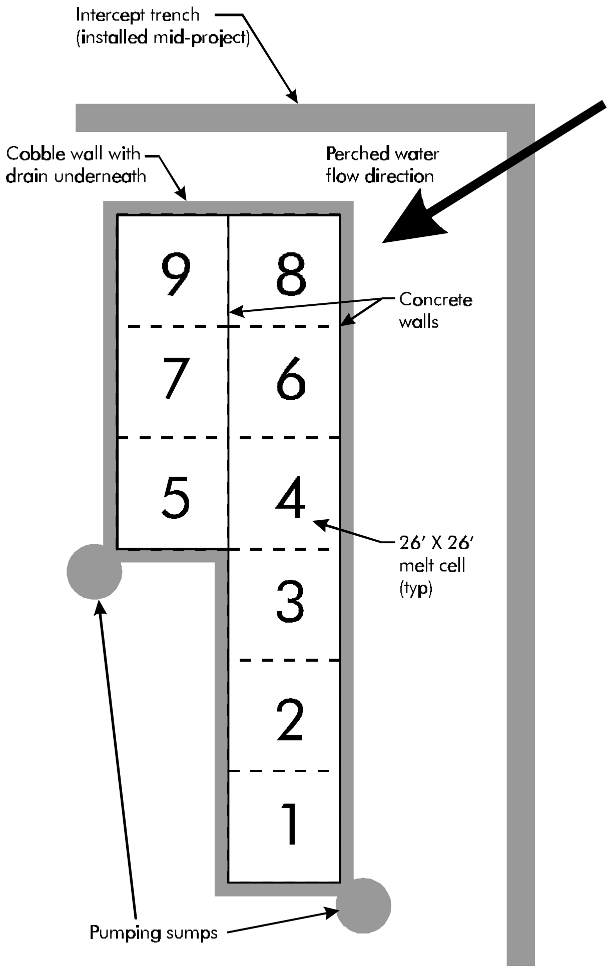

Figure 2. Plan View of Treatment Cells [25]

"ISV uses electrical current to heat (melt) and vitrify the treatment material in place. A pattern of electrically conductive graphite containing glass frit is placed on the soil in paths between the electrodes. When power is fed to the electrodes, the graphite and glass frit conducts the current through the soil, heating the surrounding area and melting directly adjacent soil.

"Molten soils are electrically conductive and can continue to carry the current which heats and melts soil downward and outward. The electrodes are allowed to progress down into the soil as it becomes molten, continuing the melting process to the desired treatment depth. One setting of four electrodes is referred to as a "melt." Performance of each melt occurs at an average rate of approximately three to four tons/hr.

"When all of the soil within a treatment setting becomes molten, the power to the electrodes is discontinued and the molten mass begins to cool. The electrodes are cut near the surface and allowed to settle into the molten soil to become part of the melt. Inorganic contaminants in the soil are generally incorporated into the molten soil which solidifies into a monolithic vitrified mass similar in characteristics to volcanic obsidian. The vitrified soil is dense and hard, and significantly reduces the possibility of leaching from the mass over the long term.

"The organic contaminants in the soil undergoing treatment are pyrolyzed (heated to decomposition temperature without oxygen) and are generally reduced to simple gases. The gases move to the surface through the dry zone immediately adjacent to the melt, and through the melt itself. Gases at the surface are collected under a stainless steel hood placed over the treatment area and then treated in an off-gas treatment system. The off-gas treatment system comprises a quencher, a scrubber, a demister, high efficiency particulate air (HEPA) filters, and activated carbon adsorption to process the off-gas before releasing the cleaned gas through a stack. A thermal oxidizer can be used following the off-gas treatment system to polish the off-gas before release to the atmosphere. A thermal oxidizer was utilized during the SITE Demonstration at the Parsons site."

System Operation

Eight melts were completed at the Parsons site from June 1993 to May 1994. As shown on Table 3, these melts ranged in duration from 10 to 19.5 days, and consumed from 559,200 to 1,100,000 kilowatt-hours of electricity per melt. The melts are expected to cool for approximately one year (i.e., until May 1995). [10-24]

TREATMENT SYSTEM DESCRIPTION (CONT.)

In Situ Vitrification System Description and Operation (cont.)

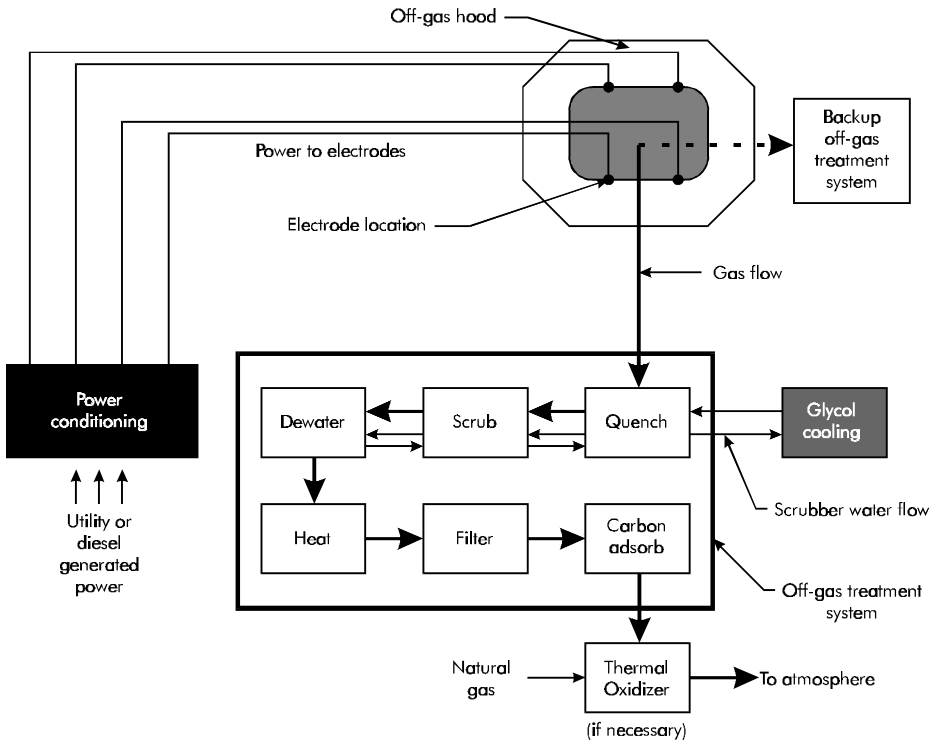

Figure 3. Geosafe In Situ Vitrification Process [41]

Table 3. Operational Data [10-24]

Melt #	Cell #	Soil Treated* (cubic yards)	Duration of Melt (days)	Power Consumed (kilowatt-hours)	Natural Gas Consumed in Thermal Oxidizer (cubic feet)
1	1 and part of 2	300	19.5	1,100,000	N/A
2	2 and part of 3	330	14	934,000	N/A
3	part of 3, 4 and 7	621	16.7	1,018,000	N/A
4	7 and part of 4, 5, and 8	672	16	996,000	N/A
5	5 and part of 4, 6, and 8	655	16	1,084,800	4,100,000
6	8 and part of 5, 7, and 9	377	10	559,200	Not Available
7	6 and part of 5, 8, and 9	575	14	836,985	Not Available
8	9 and part of 6 and 8	426	11.5	640,800	Not Available

N/A - Not applicable; thermal oxidizer not installed until after Melt #4 complete.
**Quantities shown are Geosafe estimates of contaminated and clean soil treated; total quantity of soil treated greater than 3,000 cubic yards of contaminated soil because treatment of clean soil occurred in this application.*
***SITE Demonstration Program test.*

TREATMENT SYSTEM DESCRIPTION (CONT.)

In Situ Vitrification System Description and Operation (cont.)

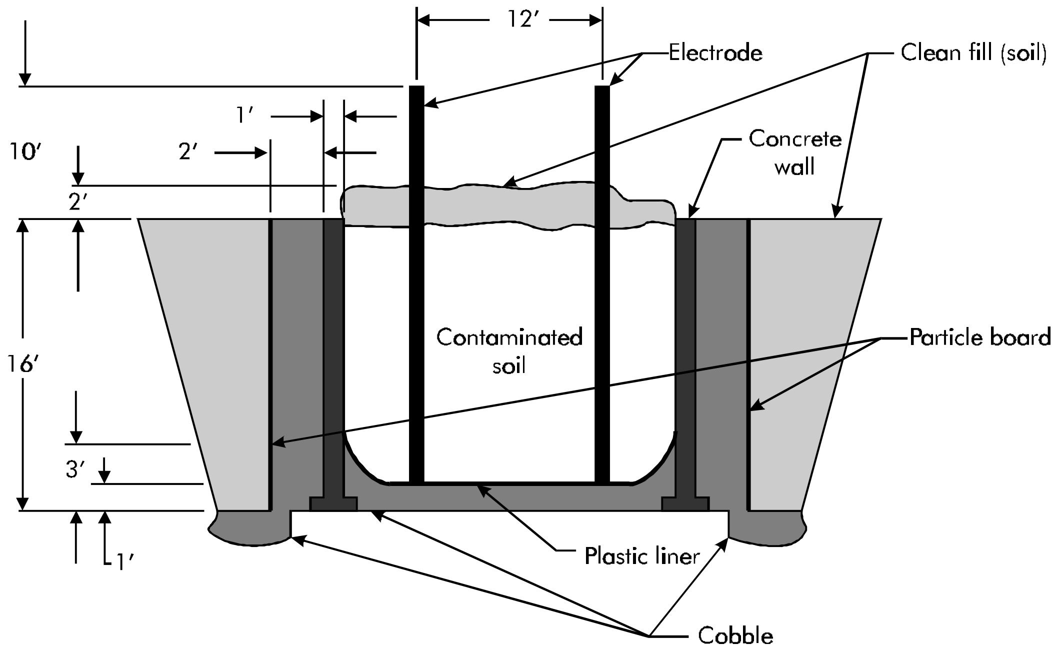

Figure 4. Side View of Typical ISV Treatment Cell [41]

The SITE Technology Capsule provides the following description of system operation at Parsons [41]:

"At the Parsons site, the original soil contamination was relatively shallow, five feet or less, and located in three main areas. To increase the economic viability of treatment at this site, the contaminated soil was excavated and consolidated into a series of nine treatment cells. The cell walls were built using concrete, cobble, and particle board as shown in Figure 4. The cells were constructed by trenching an area of the site, installing particle board and concrete forms, and pouring concrete into the forms to create the nine cell settings. A one-foot layer of cobble was placed in the bottom of each cell, and approximately two feet of cobble was used to surround the exterior of the cell forms. The use of cobble at the sides was intended as a means to retard melting out into adjacent clean soil. The bottom cobble was used to provide a drainage pathway for water that was known to be present on-site; the resultant flow of water was directed to a drainage trench. After construction, the cells were filled with contaminated soil from the site, and topped with a layer of clean soil.

"During the treatment of the first few cells, problems with the cell design were observed. The intense heat that was melting the soil was also thermally decomposing the particle board forms. Analysis of water samples collected from the diversion system surrounding the cells identified volatiles (benzene), phenolics, and epoxies that were released by this decomposition. The cobble outside of the cells created porous paths in the vicinity of treatment, thereby increasing the likelihood of vapors escaping the area outside the hood and causing irregular melt shapes.

"Geosafe responded by excavating the area outside of the remaining treatment cells and removing the particle board forms. A refractory ceramic material with insulating and reflective properties was placed adjacent to the exterior of the concrete cell walls. This helped to control the melt shape, limit fugitive vapor emissions, and restrict the melt energy inside the cell boundaries. . . . . It should be noted that the use of cobble in treatment cell construction was unique to the Parsons site where the configuration and flow of the on-site groundwater dictated its application.

TREATMENT SYSTEM DESCRIPTION (CONT.)

In Situ Vitrification System Description and Operation (cont.)

"Utility requirements for this technology include electricity, natural gas (if a thermal oxidizer is used), and water. As expected, electricity is a major consideration when implementing ISV. Total power to the electrodes during treatment is approximately three MW; the voltage applied to each of the two phases during steady state processing averages around 600 volts while the current for each phase averages approximately 2,500 amps."

Operating Parameters Affecting Treatment Cost or Performance

The major operating parameters affecting cost or performance for this technology and the values measured for each are presented in Table 4.

Table 4. Operating Parameters [10-24]

Parameter	Value	Measurement Procedure
Soil Treated	300-672 cubic yards per melt	Vendor estimate
Melt Duration	10-19.5 days per melt	-
Power Consumption	559,200-1,100,000 kWh/melt	-

Timeline

A timeline for this application is shown in Table 5.

Table 5. Timeline [1, 10-26]

Start Date	End Date	Activity
3/89	-	Parsons added to NPL
9/90	-	Action memorandum signed
10/90	4/91	Site preparation work completed (excavation and staging of 3,000 cubic yards into ISV treatment cells)
3/91	-	Operational acceptance test terminated due to fire
5/93	6/93	Mobilization of equipment and personnel to site
6/93	9/93	ISV treatment conducted
9/93	11/93	ISV treatment suspended for 9 weeks pending discussions about scrubber solution disposition, stack gas odors, groundwater disposition, and melt shape
11/93	12/93	ISV treatment continued
1/94	-	Thermal oxidizer installed to control stack gas odors
2/94	5/94	ISV treatment continued
3/94	4/94	SITE Demonstration Program test (Melt #6)
5/94	expected '95	Decontamination, dismantling, and demobilization conducted

TREATMENT SYSTEM PERFORMANCE

Cleanup Goals/Standards

Cleanup requirements were established for soils remaining on site and for off-gasses from the ISV unit, as shown below in Table 6.

Table 6. Cleanup Requirements [25, 28]

Contaminant	Soil CleanupStandards (mg/kg)	Off-Gas State ARAR (lbs/hr)
Chlordane	1	25
4,4'-DDT	4	0.01
Dieldrin	0.08	0.00028
Mercury	12	0.00059

Treatment Performance Data

Although final treatment performance data are not yet available, preliminary data for this application include results from total waste analysis and TCLP analysis of vitrified soil for pesticides and metals, and from analyses of stack gas emissions. Table 7 shows selected results from the SITE Demonstration for vitrified soil and stack emissions in melt #6. During the SITE Demonstration, three samples of vitrified soil were collected from the surface of Cell 8, and analyzed for pesticides and metals (total and TCLP). Stack gas emissions were also tested for total hydrocarbons (THC) and carbon monoxide (CO). During the SITE Demonstration, THC and CO were each measured at less than 10 ppmv. [41]

Table 8 shows typical stack gas emission performance data as reported by the vendor.

Additional samples of vitrified soil are planned to be collected after the melts cool (expected by May 1995).

Table 7. Selected Results from the SITE Demonstration Program for Melt #6 [41]

Contaminant	Before-Treatment Soil		After-Treatment Surface Soil		Stack Gas Emissions	
	Total (µg/kg)	TCLP (µg/L)	Total (µg/kg)	TCLP (µg/L)	Concentration (µg/m³)	Mass (lbs/hr)
Chlordane	<80	<0.5	<80	<0.5	<1.38	<0.000011
4,4'-DDT	2,400-23,100	0.12-0.171	<16	<0.1	<0.28	<0.0000022
Dieldrin	1,210-8,330	6.5-10.2	<16	<0.1	<0.28	<0.0000022
Arsenic	8,380-10,100	NA	717-5,490	<4-30.5	<0.269	<0.000001293
Chromium	37,400-47,600	NA	12,500-14,600	<10-17.1	2.081-3.718	0.0000148-0.0000267
Lead	<50,000	NA	<5,000-21,000	<50-4,290	<3.891	<0.0000282
Mercury	2,220-4,760	NA	<40	<0.2-0.23	12.9-17.7	0.0000989-0.000125

NA - Not analyzed.

Table 8. Typical Stack Gas Emissions [25]

Contaminant	State ARAR (lbs/hr)	Stack Gas Emission (lbs/hr)
Chlordane	25	<0.00000011
4,4'-DDT	0.01	<0.000022
Dieldrin	0.00028	<0.000022
Mercury	0.00059	0.00012

TREATMENT SYSTEM PERFORMANCE (CONT.)

Performance Data Assessment

The treatment performance data in Table 7 shows that the surface soil samples and stack gas emissions measured during the SITE Demonstration met the soil cleanup standards and off-gas State ARARs for this application. In addition, the typical stack gas emission data provided by the vendor, as shown in Table 8, show compliance with the State ARARs. The data in Table 8 show that the stack gas emissions for chlordane and 4,4'-DDT were several orders of magnitude lower than the ARARs.

The data in Table 7 show a reduction in total waste analysis concentrations from levels as high as 23,100 µg/kg to levels less than 11 µg/kg for chlordane, 4,4'-DDT, and dieldrin in surface soil samples. Concentrations of metals in a TCLP extract are shown to be reduced from as high as 21,000 µg/L to levels less than 5,000 µg/L.

Additional data from the SITE Demonstration show a volume reduction of approximately 30% for the test soil, based on the results from analyses of soil dry density.

Performance Data Completeness

Limited data are available at this time to characterize the results of the ISV application at Parsons. Data available at this time are for stack gas emissions, and for surface soil samples collected during the SITE Demonstration. Additional sampling of the vitrified soil is planned for after the melt cools (approximately May 1995).

Performance Data Quality

Soil sampling and analysis for the SITE Demonstration was conducted following EPA SW-846 analytical methods. No exceptions to the methods were noted in the available references. The SITE Technology Capsule, however, identified a possibility that other, non-EPA approved, methods may provide more accurate determinations for metals in vitrified materials.

TREATMENT SYSTEM COST

Procurement Process

EPA contracted with Geosafe Corporation to construct and operate the ISV system at the site. Geosafe used several subcontractors to implement specific aspects of the operation.

Information about the competitive nature of the procurement process is not available at this time. [10]

Treatment System Cost

Although final cost information is not yet available, preliminary treatment system cost information is available from EPA, as presented in Tables 9-12. An action memorandum identified cost ceilings for this application totalling $3,466,967, including $1,763,000 for the cleanup contractor, as shown in Table 9. [1] In negotiating the contract with Geosafe, EPA established objectives for nine cost elements, as shown in Tables 10-12. The delivery order for Geosafe specified a ceiling value of $1,690,305. The reason for the discrepancy between the $1,763,000 and $1,690,305 values is not available at this time. [24]

In order to standardize reporting of costs among projects, costs are shown in Tables 10-12 according to the format for an interagency Work Breakdown Structure (WBS). The WBS specifies 9 before-treatment cost elements, 5 after-treatment

TREATMENT SYSTEM COST (CONT.)

Treatment System Cost (cont.)

cost elements, and 12 cost elements that provide a detailed breakdown of costs directly associated with treatment. Tables 10, 11, and 12 present the cost elements exactly as they appear in the WBS, along with the specific activities, and unit cost and number of units of the activity (where appropriate), as provided in the Contract Negotiation Cost Objectives. [31]

Table 9. Cost Ceilings Shown in Action Memorandum [1]

Cleanup Contractor	$1,763,000
Contingency (15%)	$264,450
Subtotal	$2,027,450
TAT	$716,000
Extramural subtotal	$2,743,450
Extramural Contingency	$411,517
Total for Extramural Costs	$3,154,967
U.S. EPA Direct Costs	$120,000
EPA Indirect Costs	$192,000
TOTAL for Intramural Costs	$312,000
TOTAL for Removal Project	3,466,967

Table 10. Before-Treatment Cost Elements [Adapted from 31]

Cost Element	Cost Objective
Mobilization and Preparatory Work	
– Mobilization	$150,000
– Site Administration	$220,000
– Site Preparation	$4,000
Monitoring, Sampling, Testing, and Analysis	
– Soil	$80,000
– Glass	$10,000
– Air	$130,000
– Water	$25,000
Site Work	
– Uncontaminated Soil	$80,000
– Contaminated Soil	$100,000

Table 11. Treatment Cost Elements [31]

Cost Element	Cost Objective
Operation (short-term – up to 3 years)	
– Vitrification	$800,000

TREATMENT SYSTEM COST (CONT.)

Treatment System Cost (cont.)

Table 12. After-Treatment Cost Elements [Adapted from 31]

Cost Element	Cost Objective
Site Restoration	
– Backfill and Grade	$80,000
– Seeding	$4,500
– Drainage Structures	$2,500
Demobilization	$77,000

Cost Data Quality

Limited data are available at this time to assess the cost for this treatment application. The cost data shown in this report were provided by EPA as contract negotiation cost objectives.

Vendor Input

The vendor stated that the costs for the application at Parsons were unusually high, and expects that the costs for future applications will be lower. Key factors affecting costs for ISV include: [41]

- Cost of the local price of electricity;
- Depth of processing;
- Soil moisture content; and
- Treatment volume.

OBSERVATIONS AND LESSONS LEARNED

Cost Observations and Lessons Learned

- The cleanup contractor's cost ceiling for the ISV treatment application at Parsons was $1,763,000, including $800,000 for vitrification operations, which corresponds to $270 in costs for vitrification per cubic yard of soil treated.
- The before-treatment costs for this application of $800,000 were high because of the need to excavate and stage the wastes prior to treatment.

Performance Observations and Lessons Learned

- The surface soil samples and stack gas emissions measured during the SITE Demonstration, and the typical stack gas emission results provided by the vendor, met the soil cleanup standards and emissions standards for this application.
- Typical stack gas emissions for chlordane and 4,4'-DDT were several orders of magnitude lower than the ARARs.
- Based on the results of the SITE demonstration:
  1. The total waste analysis concentrations in surface soil samples were reduced from levels as high as 23,100 µg/kg to levels less than 11 µg/kg for chlordane, 4,4'-DDT, and dieldrin.
  2. Concentrations of metals in a TCLP extract of surface soil samples were reduced from as high as 21,000 µg/L to levels less than 5,000 µg/L.
  3. A volume reduction of approximately 30% for the test soil was achieved in this application, based on the results from analyses of soil dry density.

OBSERVATIONS AND LESSONS LEARNED (CONT.)

Other Observations and Lessons Learned

- Additional sampling of the vitrified soil is planned for after the melt cools (approximately May 1995).

REFERENCES

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6. Action Memorandum, Request for Removal Action at Parsons/ETM Enterprises Site, Edward C. Burk, Jr. to Basil G. Constantelos, undated.
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23. Len Zintak, OSC, EPA Region V, Polrep #20, March 27, 1994.
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30. EPA News Release, October 11, 1990.

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Analysis Preparation

This case study was prepared for the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response, Technology Innovation Office. Assistance was provided by Radian Corporation under EPA Contract No. 68-W3-0001.

COST AND PERFORMANCE REPORT
(Interim Report)

In Situ Vitrification
at the
Parsons Chemical/ETM Enterprises Superfund Site
Grand Ledge, Michigan

Prepared By:

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Technology Innovation Office

March 1995

Notice

Preparation of this report has been funded wholly or in part by the U.S. Environmental Protection Agency under Contract Number 68-W3-0001. It has been subject to administrative review by EPA headquarters and Regional staff and by the technology vendor. Mention of trade names for commercial products does not constitute endorsement or recommendation for use.

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Solid Waste and Emergency Response
Technology Innovation Office